WELDED WIRE WALL
April 30, 2001

General Requirements

1.01 Description

A. This work consists of constructing welded wire wall in accordance with the Plans, the Standard Specifications and these Special Provisions, and in conformity with the lines, grades, design and dimensions shown in the Plans or as established by the Engineer.

B. The welded wire wall shall be constructed only with the Hilfiker Welded Wire Retaining Wall (WWW) system. Hilfiker is a registered trademark of Hilfiker Retaining Walls.

1.02 Quality Assurance

A. The completed wall shall meet the following tolerances:

1. Deviation from the design batter and horizontal alignment shall not exceed 2 inches when measured along a 10 foot straight edge.

2. Deviation from the overall design batter of the wall shall not exceed 1.5 inches per 10 feet of wall height.

3. The maximum outward bulge of the face between wall backfill reinforcement layers shall not exceed 2 inches.

4. The base of the retaining wall excavation shall be within 3 inches of the staked elevations unless otherwise directed by the Engineer.

5. The external wall dimensions shall be placed within 2 inches of that staked on the ground.

B. The welded wire wall manufacturer shall provide a qualified and experienced representative at the job site, at the start of wall construction and as needed, to resolve wall construction problems as directed by the Engineer. Recommendations made by the representative and approved by the Engineer shall be followed by the Contractor.

1.03 Submittals

A. The Contractor, or the supplier as the Contractor's agent, shall furnish to the Engineer a Certificate of Compliance certifying that all welded wire wall materials, including welded wire mats, backing mats, and construction geotextile for wall facing, comply with the applicable sections of these Specifications.

B. A copy of all test results performed by the Contractor or the Contractor's supplier which are necessary to assure compliance with the specifications shall also be furnished to the Engineer.

C. Before fabrication, the Contractor shall submit a field construction manual for the welded wire wall, prepared by the wall manufacturer, to the Engineer

for approval in accordance with Section 6-01.9. This manual shall provide step-by-step directions for construction of the wall system.

D. Design Calculations and Shop Drawings

The Contractor, or the supplier as the Contractor's agent shall submit detailed design calculations and shop drawings to the Engineer for approval in accordance with Section 6-01.9 and this Special Provision. The Contractor shall not begin wall construction without the Engineer's written approval of the design calculations and shop plans.

The submittal shall include detailed design calculations and all details, dimensions, quantities, and cross-sections necessary to construct the wall. The calculations shall include a detailed explanation of any symbols and computer programs used in the design of the walls. All computer output submitted shall be accompanied by supporting hand calculations detailing the calculation process.

The design calculations shall be based on the current AASHTO Standard Specifications for Highway Bridges including current interims, and also based on the following:

a. The factor of safety for overturning and sliding are 2.0 and 1.5 respectively for AASHTO Load Group I, and 1.5 and 1.1 respectively for AASHTO Load Group VII.

b. The wall surcharge conditions (backfill slope) shown in the Plans.

c. If a highway is adjacent to and on top of the wall, a 2 foot surcharge shall be used in the design.

d. If the Plans detail a traffic barrier on top of the wall, the barrier and wall shall be capable of resisting a 10,000 pound horizontal load applied at the top of the barrier.

e. The following design parameters shall be used:

Soil Properites	Wall Backfill	Retained Soil	Foundation Soil
Unit Weight (pcf)	***$$1$$***	***$$2$$***	***$$3$$***
Friction Angle (deg)	***$$4$$***	***$$5$$***	***$$6$$***
Cohesion (psf)	***$$7$$***	***$$8$$***	***$$9$$***

	AASHTO Load Group I	AASHTO Load Group VII
Allowable Bearing Capacity (tsf)	***$$10$$***	***$$11$$***
Acceleration Coefficient (g)	N/A	***$$12$$****

A minimum of six sets of shop plans shall be fully detailed and submitted on 24 inch x 36 inch or 22 inch x 34 inch sheets and shall include, but not be limited to, the following items:

a. A plan and elevation sheet or sheets for each wall, containing the following:

    1. An elevation view of the wall which shall indicate the elevation at the top of the wall, at all horizontal and vertical break points and at least every 50 feet along the wall; elevations at the bottom of the wall, the distance along the face of the wall to all steps in the wall bottom; the designation as to the type of panel or module; the length, size, and wire sizes and spacings of the welded wire mats and backing mats, and the distance along the face of the wall to where changes in length, size, and wire sizes and spacings of the welded wire mats and backing mats occur; and the location of the original and final ground line.

    2. A plan view of the wall which shall indicate the offset from the construction centerline to the face of the wall at all changes in horizontal alignment; the limit of the widest welded wire mat, and the centerline of any drainage structure or drainage pipe which is behind or passes under or through the wall.

    3. Any general notes required for design and construction of the wall.

    4. All horizontal and vertical curve data affecting wall construction.

    5. A listing of the summary of quantities provided on the elevation sheet of each wall for all items including incidental items.

    6. Cross-section showing limits of construction. In fill sections, the cross-section shall show the limits and extent of select granular backfill material placed above original ground.

    7. Limits and extent of reinforced soil volume.

b. All details for foundations and wall base details, including details for steps in the foundations or wall base, as well as allowable and actual maximum bearing pressures for AASHTO Load Groups I and VII.

c. All modules and facing elements shall be detailed. The details shall show all dimensions necessary to construct the element, and the location of reinforcement element attachment devices to the facing.

d. All details for construction of the wall around drainage facilities, sign, signal, luminaire , and noise wall foundations, and structural abutment and foundation elements shall be clearly shown.

e. All details for connections to traffic barriers, coping, parapets, noise walls, and attached lighting shall be shown.

f. All details for the traffic barrier attached to the top of the wall (if shown in the Plans).

g. The plans shall be prepared and signed by a professional engineer, licensed in the State of Washington.

Materials

2.01 General

A. The Contractor shall make arrangements to purchase the welded wire mats, backing mats, facing elements, fasteners, and all necessary incidentals from the following source:

Hilfiker Retaining Walls
P.O. Box 2012
Eureka, CA 95501-2012
(707) 443-5093
FAX (707) 443-2891

2.02 Welded Wire Mats and Backing Mats

A. Welded wire fabric for welded wire mats and backing mats shall conform to AASHTO M 32, and shall be fabricated from smooth wire fabric conforming to AASHTO M 55.

B. Welded wire fabric wire size for the backing mats shall be W2.9 minimum. The minimum clear opening dimension of the backing mat shall not exceed the minimum particle size of the wall facing backfill as specified in subsection 2.03.C.

C. Welded wire fabric for welded wire mats and backing mats shall be galvanized after fabrication in accordance with ASTM A 641 (2 ounces minimum per square foot). All damage to galvanizing shall be repaired with Formula A-9-73 Galvanizing Repair Paint in accordance with Section 9-08.2.

2.03 Backfill Material

A. All backfill material used in the welded wire wall reinforced zone shall be free draining, free from organic or otherwise deleterious material.

B. Backfill material within the reinforced zone, except for the wall facing backfill placed immediately behind the wall face as shown in the Plans, shall conform to the specifications for gravel borrow as specified in Section 9-03.14(1).

C. The coarse, granular material used for the wall facing backfill placed immediately behind the wall face, as shown in the Plans, shall conform to the following gradation requirements:

1. The minimum particle size shall be no less than the width of the minimum opening dimension in the backing mat.

2. The maximum particle size shall be no greater than 6 inches.

D. All material within the wall reinforced zone shall be substantially free of shale or other soft, poor durability particles, and shall not contain recycled materials, such as glass, shredded tires, portland cement concrete rubble, or asphaltic concrete rubble. The material shall meet the following aggregate durability requirements:

Property	Test Method	Allowable Test Value
Los Angeles Wear, 500 Rev.	AASHTO T-96	35% Max.
Degradation	WSDOT Test Method 113	15% min.

E. All material within the wall reinforced zone shall meet the following corrosive requirements:

Property	Test Method	Allowable Test Value
Resistivity	AASHTO T 288	3,000 ohm-cm, min.
pH	AASHTO T 289	5 to 10
Chlorides	AASHTO T 291	100 ppm max.
Sulfates	AASHTO T 290	200 ppm max.

If the resistivity of the backfill material equals or exceeds 5,000 ohm-cm, the specified chloride and sulfate limits may be waived.

2.04 Contruction Geotextile for Wall Facing

A. Construction Geotextile for Underground Drainage, Moderate Survivability, Class A meeting the requirements of Section 9-33 shall be used for placement between the backfill material within the reinforced zone and the coarse granular material immediately behind the facing as shown in the Plans.

Construction Requirements

3.01 Wall Excavation

A. Excavation shall be in accordance with the requirements of Section 2-09 and in conformity to the limits and construction stages shown in the Plans.

3.02 Foundation Preparation

A. The foundation for the structure shall be graded level for a width equal to or exceeding the length of reinforcing as shown in the approved shop drawings.

B. Prior to wall construction, the foundation, if not in rock, shall be compacted as directed by the Engineer.

C. Any foundation soils found to be unsuitable shall be removed and replaced as provided for under Section 2-09.3(1)C.

3.03 Wall Erection

A. The Contractor shall construct the welded wire wall in accordance with the Special Provisions and the wall manufacturer's field construction manual.

3.04 Backfill Placement

A. Backfill shall be placed in a manner that segragation does not occur. Mixing of backfill materials during placement in the wall to meet contract backfill gradation requirements will not be allowed.

B. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer of material.

1. The moisture content of all backfill material shall meet the requirements of Section 2-03.3(14)C.

2. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniformly acceptable throughout the entire lift.

3. The Optimum Moisture Content shall be determined in accordance with Section 2-03.3(14)D.

C. The Contractor shall not end dump fill material directly on the construction geotextile for wall facing unless otherwise approved by the Engineer. The Contractor shall ensure that 6 inches minimum of backfill shall be between the construction geotextile for wall facing and any construction vehicle or equipment tires or tracks at all times.

D. Backfill shall be compacted to 95 percent of the maximum density as specified under Compacting Earth Embankments, Method C, in Section 2-03.3(14)C, except as modified herein:

1. The maximum lift thickness after compaction shall not exceed 10 inches.

2. The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density.

3. The Contractor shall not use sheepsfoot rollers or rollers with protrusions for compacting first lift of backfill above construction geotextile for wall facing each layer of welded wire mats. Rollers which have a mass greater than 6,000 pounds shall be used with the vibrator turned off. The Contractor may use rollers which have a mass less than or equal to 6,000 pounds with the vibrator turned on with the prior approval of the Engineer.

4. The Contractor shall compact the zone within three feet of the back of the wall face without causing damage to or distortion of the construction geotextile for wall facing, welded wire mats, and backing mats by using light mechanical tampers approved by the Engineer. No soil density tests shall be taken in this area.

E. At the end of each day's operation, the Contractor shall shape the last level of backfill to permit runoff of rainwater away from the wall face. In addition,

the Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

F. Wall materials damaged or disturbed during backfill placement shall be either removed and replaced, or adjusted and repaired, by the Contractor as approved by the Engineer at no additional expense to the Contracting Agency.

3.05 Installing Guardrail Posts

A. Where guardrail posts are required, the Contractor shall not begin installing guardrail posts until completing the welded wire wall to the top of wall elevation shown in the Plans. The Contractor shall install may cut welded wire reinforcement to facilitate placing the guardrail posts, but only in the top two reinforcement layers and only with the approval of the Engineer in a manner that prevents bulging of the wall face and prevents ripping or pulling of the welded wire reinforcement. Holes through the welded wire reinforcement shall be the minimum size necessary for the post. The Contractor shall demonstrate to the Engineer prior to beginning guardrail post installation that the installation method will not rip or pull the welded wire reinforcement.

Measurement

4.01 Welded Wire Wall

A. The welded wire wall will be measured by the square foot of completed wall in place. The vertical limits for measurement are from the bottom of the bottom mat to the top of wall as shown in the Plans. The horizontal limits for measurement are from the end of wall to the end of wall.

B. The backfill material will be measured by the cubic yard in place determined by the limits shown in the Plans.

C. Excavation will be measured by the cubic yard to the limits shown in the Plans.

D. Shoring or extra excavation Class B will be measured by the square foot in accordance with Section 2-09.4.